PATENT ABSTRACTS OF JAPAN

(11) Publication number : 2002 -258300
(43) Date of publication of application : 11.09.2002

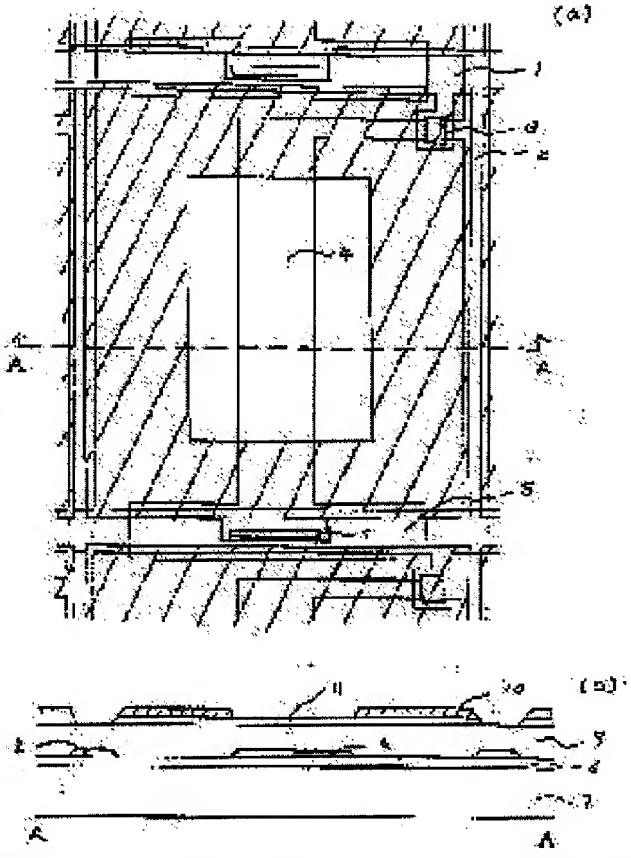
(51) Int.Cl. G02F 1/1343

(21) Application number : 2001 -399153
(22) Date of filing : 07.10.1997

(71) Applicant : SHARP CORP
(72) Inventor : NISHIKI HIROHIKO

(54) ACTIVE -MATRIX TYPE LIQUID CRYSTAL DISPLAY

(57) Abstract:
PROBLEM TO BE SOLVED: To provide a state of display in a liquid crystal display by which the power consumption is minimized in a brightened area while having an ample brightness for display in a darkened area.
SOLUTION: In the active -matrix substrate a picture element electrode for reflection 10 and a picture element electrode for transmission 11 are provided in one picture element. As indicated in Fig. 2, the picture element electrode part 10 for an extraneous light reflection and the picture element electrode part 11 for backlighting transmission are formed in one picture element.



LEGAL STATUS

[Date of request for examination] 28.12.2001

[Date of sending the examiner's decision of rejection] 21.10.2003

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] An insulating substrate, two or more gate wiring prepared on this insulating substrate, and two or more data wiring which intersects this gate wiring, The active-matrix substrate which has the driver element prepared in the intersection of this gate wiring and this data wiring, and the picture element electrode electrically connected to this driver element, In the active matrix liquid crystal display which has the liquid crystal layer which intervened between the opposite substrate with which the counterelectrode was formed, and said active-matrix substrate and said opposite substrate, and a back light Said picture element electrode is an active matrix liquid crystal display characterized by having a picture element electrode for an echo, and a picture element electrode for transparency.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the liquid crystal display equipped with the transparency viewing area and the reflective viewing area.
[0002]
[Description of the Prior Art] As a liquid crystal display, the active matrix liquid crystal display in which the thin film transistor (TFT) or MIM component constituted by the amorphous silicon was formed on the substrate is known with gate wiring of every two or more which crosses mutually, and data wiring.
[0003] There are a transparency mold liquid crystal display which uses a back light as the light source, and a reflective mold liquid crystal display which reflects an external light and is used for a display in this active-matrix substrate.
[0004] In these active matrix liquid crystal displays, the transparency mold liquid crystal display and reflective mold liquid crystal display of high numerical aperture structure which make a picture element electrode superimpose on gate wiring and data wiring through an interlayer insulation film are developed, using organic materials, such as photosensitive transparence acrylic resin, as an interlayer insulation film.
[0005] Drawing 8 (a) is the top view of the reflective mold liquid crystal display of the high numerical aperture structure where the organic compound insulator was used as an interlayer insulation film, and drawing 8 (b) is the sectional view showing the F-F cross section of drawing 8 (a).
[0006] The active matrix liquid crystal indicating equipment shown in drawing 8 is equipped with the gate wiring 1, the data wiring 2, a driver element 3, the drain electrode 4, the auxiliary capacity electrode 5, gate dielectric film 6, the insulating substrate 7, a contact hole 8, an interlayer insulation film 9, the picture element electrode 10 for an echo, and the auxiliary capacity wiring 12.
[0007] It can consider as a transparency mold liquid crystal display by using as the electrode of transparence the picture element electrode 10 for an echo of the active matrix liquid crystal display shown in drawing 8 .
[0008] In order to reduce the capacity generated by making a picture element electrode superimpose on gate wiring and data wiring through an interlayer insulation film 9 as an ingredient of the interlayer insulation film 9 used for this high numerical aperture structure, it is required that forming by the thickness of several micrometers is easy, that a dielectric constant should be small as compared with silicon nitride etc., etc., and the organic compound insulator is used.
[0009] Moreover, although it is necessary to form a contact hole in an interlayer insulation film 9 in order to form this high numerical aperture structure, and to take electric contact of the drain electrode 4 arranged by the lower layer of an interlayer insulation film 9, and the picture element electrode arranged in the upper layer of an interlayer insulation film 9 After applying a liquefied resin ingredient to a substrate by the spin applying method by using photosensitive acrylic resin as an interlayer insulation film 9, Since it can expose at a FOTORISO process, patterning can be carried out by performing development by the alkaline solution and a contact hole can be formed, it is possible to perform membrane formation and patterning simultaneously.
[0010]

[Problem(s) to be Solved by the Invention] In order that the transparency mold liquid crystal display which uses the light from a back light for a display might use a back light, there was much power consumption, and when a dc-battery was used, it had the trouble that continuous duty time amount was short.
[0011] Moreover, although there was little power consumption and it had the advantage in which continuous duty time amount was long since a back light was not used for a reflective mold liquid crystal display, reflectivity was not enough and there was a trouble of being hard to use it in a dark place.
[0012]
[Means for Solving the Problem] Two or more gate wiring with which this invention was prepared on the insulating substrate and this insulating substrate, The driver element prepared in the intersection of two or more data wiring which intersects this gate wiring, and this gate wiring and this data wiring, The active-matrix substrate which has the picture element electrode electrically connected to this driver element, In the active matrix liquid crystal display which has the liquid crystal layer which intervened between the opposite substrate with which the counterelectrode was formed, and said active-matrix substrate and said opposite substrate, and a back light Said picture element electrode is characterized by having a picture element electrode for an echo, and a picture element electrode for transparency.
[0013] the transparency echo which according to this invention uses as a reflective mold liquid crystal display in a bright place, turns on a back light in a dark place and can be used as a transparency mold liquid crystal display -- formation of a switchable active matrix liquid crystal indicating equipment is attained.
[0014] Moreover, this invention is characterized by connecting electrically said picture element electrode for an echo, and said picture element electrode for transparency.
[0015] Since the picture element electrode for an echo and the picture element electrode for transparency are connected electrically, it is not necessary to prepare wiring for inputting a driving signal independently, and according to this invention, the configuration of a active-matrix substrate can be simplified.
[0016] Moreover, this invention is characterized by forming said picture element electrode for an echo in the upper part of said driver element.
[0017] According to this invention, the picture element electrode for an echo is formed on a driver element, and it can prevent the light from the outside carrying out incidence to a driver element.
[0018] Moreover, this invention is characterized by making larger than the area of the part which penetrates the light of a back light with said picture element electrode for transparency area of the part which reflects an external light with said picture element electrode for an echo.
[0019] According to this invention, the picture element electrode for transparency is not contributed to the brightness of a panel, when having switched off the back light, but in order to contribute to the brightness of a panel irrespective of burning of a back light, and putting out lights, the picture element electrode for an echo which reflects the light from the outside can stabilize the brightness of a display by enlarging the area, when the light of a back light puts out the light, or also when brightness is low.
[0020] Moreover, this invention is characterized by preparing a micro lens between said active-matrix substrates and said back lights.
[0021] The brightness of a display can be raised even if it does not raise the brightness of the back light itself, since the light from the back light covered with the picture element electrode for an echo, gate wiring, etc. can be brought together in the picture element electrode for transparency according to this invention.
[0022] Moreover, this invention is characterized by having formed the interlayer insulation film which has a ramp or the concavo-convex section on said drain electrode, and forming said picture element electrode for an echo on this interlayer insulation film.
[0023] Since a flare comes out in the direction in which the light from the outside is reflected by the picture element electrode for an echo according to this invention, an angle of visibility can be extended.
[0024] Moreover, this invention is characterized by forming said picture element electrode for an

echo in the same layer as said gate wiring or said data wiring.
[0025] According to this invention, there is no need of establishing independently the process which forms the picture element electrode for an echo, and a routing counter and a manufacturing cost are not made to increase.
[0026] Moreover, this invention is characterized by connecting electrically gate wiring of the picture element which adjoined said picture element electrode for an echo formed in the same layer as said gate wiring.
[0027] According to this invention, since it connects with gate wiring and an electric target and the picture element electrode for an echo is, stray capacity-ization can be prevented and auxiliary capacity can be formed between drain electrodes.
[0028] Moreover, this invention is characterized by inputting the same signal as the signal impressed to said counterelectrode into said picture element electrode for an echo formed in the same layer as said gate wiring.
[0029] Since the same signal as the signal impressed to a counterelectrode is inputted into the picture element electrode for an echo according to this invention, stray capacity-ization can be prevented.
[0030] Moreover, this invention is characterized by superimposing said picture element electrode for an echo and drain electrode, or the picture element electrode for transparency formed in the same layer as said gate wiring, and forming auxiliary capacity.
[0031] According to this invention, the auxiliary capacity of the electrical potential difference impressed to a picture element electrode can be formed using the picture element electrode for an echo.
[0032]
[Embodiment of the Invention] (Operation gestalt 1) Drawing 1 (a) shows the top view of the active-matrix substrate of the operation gestalt 1 of this invention, and drawing 1 (b) shows the sectional view of the A-A cross section of drawing 1 (a).
[0033] The active-matrix substrate is equipped with the gate wiring 1, the data wiring 2, a driver element 3, the drain electrode 4, the auxiliary capacity electrode 5, gate dielectric film 6, the insulating substrate 7, the contact hole 8, the interlayer insulation film 9, the picture element electrode 10 for an echo, and the picture element electrode 11 for transparency.
[0034] It connects as electrically as the drain electrode 4, and the auxiliary capacity electrode 5 is superimposed on the gate wiring 1 through gate dielectric film 6, and forms auxiliary capacity.
[0035] The contact hole 8 is established in the interlayer insulation film 9, in order to connect the picture element electrode 11 for transparency, and the auxiliary capacity electrode 5.
[0036] This active-matrix substrate is equipped with the picture element electrode 10 for an echo, and the picture element electrode 11 for transparency into one picture element, and as shown in drawing 2 , it forms picture element electrode 10 part for an echo which reflects the light from the outside into one picture element, and picture element electrode 11 part for transparency which penetrates the light of a back light.
[0037] Drawing 2 is the sectional view showing the liquid crystal display using the active-matrix substrate shown in drawing 1 , and has the data wiring 2, the drain electrode 4, gate dielectric film 6, the insulating substrate 7, an interlayer insulation film 9, the picture element electrode 10 for an echo, the picture element electrode 11 for transparency, the light filter layer 13, a counterelectrode 14, the liquid crystal layer 15, the orientation film 16, the polarizing plate 17, and the back light 18.
[0038] It is more desirable to make area of picture element electrode 10 part for an echo larger than picture element electrode 11 part for transparency, in order that picture element electrode 10 part for an echo which reflects the light from the outside may contribute to the brightness of a panel irrespective of burning of a back light and putting out lights, although picture element electrode 11 part for transparency which penetrates the light of a back light 18 does not contribute to the brightness of a panel when having switched off the back light.
[0039] Although the picture element electrode 10 for an echo was formed on the picture element electrode 11 for transparency and it has connected electrically with this operation gestalt in order to input the same signal as the picture element electrode 10 for an echo, and the picture element electrode 11 for transparency, the picture element electrode 10 for an echo and the picture element electrode 11 for transparency may not be connected electrically, but another signal may be inputted

into each, and a separate display may be performed.
[0040] The light from the back light 18 by which incidence is carried out to the field in which the picture element electrode 10 for an echo was formed in the liquid crystal display of drawing 2 Since it cannot use as a display light, as shown in the sectional view of the liquid crystal display shown in drawing 3 , a micro lens 19 and the micro-lens protective layer 20 are formed between a back light 18 and a liquid crystal display panel. Make the field of the picture element electrode 11 for transparency in which the picture element electrode 10 for an echo is not formed of a micro lens 19 condense back light light, the amount of the light which penetrates the picture element electrode 11 for transparency is made to increase, and the brightness of a display can be raised.
[0041] Drawing 4 (a) shows the top view of the active-matrix substrate of other examples of this operation gestalt, and the sectional view of the B-B cross section of drawing 4 (a) is shown, drawing 4 (b) may be reversing the field of the picture element electrode 10 for an echo, and the picture element electrode 11 for transparency to drawing 1 , and it may change suitably the surface ratio of the picture element electrode 10 for an echo, and the picture element electrode 11 for transparency.
[0042] When the active-matrix substrate of drawing 1 is compared with the active-matrix substrate of drawing 4 , since the direction of the active-matrix substrate of drawing 1 forms the picture element electrode 10 for an echo on a driver element 3, and it can prevent the light from the outside carrying out incidence to a driver element 3 and it is arranged in the center whose picture element electrode 11 for transparency is a picture element, it is easy to form the micro lens 19 for condensing.
[0043] In this invention, although the way which gathers a numerical aperture as much as possible adopted high numerical aperture **** which intervened the interlayer insulation film 9 which consists of an organic compound insulator between a picture element electrode, the gate wiring 1, and source wiring 3 with ****** and this operation gestalt in order to form the part which reflects light into one picture element, and the part to penetrate, other structures may be used.
[0044] (Operation gestalt 2) Drawing 5 (a) shows the top view of the active-matrix substrate of the operation gestalt 2, and drawing 5 (b) shows the sectional view of the C-C cross section of drawing 5 (a).
[0045] The active matrix liquid crystal display of the operation gestalt 2 forms the picture element electrode 10 for an echo on the interlayer insulation film 9 in which a ramp or the concavo-convex section was formed, and since a flare comes out in the direction in which the light from the outside is reflected by the picture element electrode 10 for an echo, it can extend an angle of visibility.
[0046] Moreover, if an interlayer insulation film 9 is the thickest on the gate wiring 1 or the data wiring 2, and a ramp or the concavo-convex section is formed so that it may not form on the drain electrode 4, there is no need of forming the contact hole for taking electric contact of the drain electrode 4 and the picture element electrode 10, and since the orientation turbulence of the liquid crystal molecule generated for the steep level difference in the contact hole section can be prevented, a large numerical aperture can be taken.
[0047] The drain electrode 4 serves as the picture element electrode for transparency, and is a transparent electrode which consists of ITO etc.
[0048] Moreover, it is necessary to hold down the tilt angle of the ramp of an interlayer insulation film 9, or the concavo-convex pitch of the concavo-convex section to the include angle which is extent which can perform rubbing processing enough after forming the orientation film, and conditions [******] are used for it to each rubbing conditions and a liquid crystal molecule.
[0049] A micro lens can be prepared in drain electrode 4 part which served as the picture element electrode for transparency also in this operation gestalt, and the brightness at the time of back light burning can be increased.
[0050] (Operation gestalt 3) Drawing 6 (a) shows the top view of the active-matrix substrate of the operation gestalt 3, and drawing 6 (b) shows the sectional view of the D-D cross section of drawing 6 (a).
[0051] In this operation gestalt, the picture element electrode 10 for an echo is formed in the same layer as the gate wiring 1 at the same process.
[0052] If it does in this way, there will be no need of establishing independently the process which forms the picture element electrode 10 for an echo, and a routing counter and a manufacturing cost

will not be made to increase.
[0053] In the case of this operation gestalt, the picture element electrode 10 for an echo is not connected with the drain electrode 4 of a driver element 3, but it is used only for reflecting the light from the outside, and the picture element electrode 11 for transparency performs a role of an electrode for driving liquid crystal.
[0054] Namely, control of the permeability of light which the picture element electrode 10 for an echo reflected is performed by controlling a liquid crystal layer by the electrical potential difference of the picture element electrode 11 for transparency.
[0055] Under the present circumstances, if no signals are inputted into the picture element electrode 10 for an echo, since stray capacity will occur between the drain electrode 4 or the picture element electrode 11 for transparency, it is desirable to input into the picture element electrode 10 for an echo a signal which does not have an adverse effect on a display, by connecting with the adjoining gate wiring 1, stray capacity-ization can be prevented and auxiliary capacity can be formed between the drain electrodes 4.
[0056] The brightness at the time of back light burning can be increased by condensing to the picture element electrode for transparency by the micro lens also in this operation gestalt.
[0057] It is more desirable for this invention to also gather a numerical aperture as much as possible, in order to form the part which reflects light into one picture element, and the part to penetrate.
[0058] So, other structures may be used although the high numerical aperture structure which used the organic compound insulator for the interlayer insulation film was adopted as a configuration of this operation gestalt.
[0059] (Operation gestalt 4) The top view of the active-matrix substrate of the operation gestalt 4 is shown in drawing 7 (a), and the sectional view of the E-E cross section of drawing 7 (a) is shown in drawing 7 (b).
[0060] This operation gestalt forms the picture element electrode 10 for an echo in the same layer as the data wiring 2.
[0061] If it does in this way, in case the data wiring 2 is formed, the picture element electrode 10 for an echo can be formed, and a routing counter and a manufacturing cost will not be made to increase.
[0062] Since the high numerical aperture structure which minded the interlayer insulation film 9 also in the case of this operation gestalt is adopted, it is used only for the picture element electrode 10 for an echo reflecting the light from the outside like the operation gestalt 3, and only the picture element electrode 11 for transparency performs a role of an electrode for driving a liquid crystal molecule.
[0063] That this operation gestalt differs from the operation gestalt 3 here is a point currently formed in the form which the drain electrode 4 and the picture element electrode for an echo connected electrically, and when using the drain electrode 4 as a picture element electrode for transparency, without forming an interlayer insulation film 9, it also contributes the picture element electrode 10 for an echo to actuation of a liquid crystal molecule.
[0064] The brightness at the time of back light burning can be increased by condensing to the picture element electrode 11 for transparency by the micro lens also in this operation gestalt.
[0065] It is more desirable to raise a numerical aperture also with this operation gestalt as much as possible, in order to form the part which reflects light into one picture element, and the part to penetrate.
[0066] So, other configurations may be used although the high numerical aperture structure which used the organic compound insulator for the interlayer insulation film was adopted as a configuration of this operation gestalt.
[0067]
[Effect of the Invention] According to this invention, the active matrix liquid crystal display which can change a reflective mold and a transparency mold can be formed.
[0068] Though sufficient brightness is taken out with any operating conditions when a user changes an echo to transparency according to an operating condition by this, a liquid crystal display that there is little power consumption and usable for a long time is realizable.
[0069] moreover, the transparency echo which uses as a reflective mold liquid crystal display in a bright place, turns on a back light in a dark place and can be used as a transparency mold liquid crystal display -- formation of a switchable active matrix liquid crystal indicating equipment is

attained.
[0070] Moreover, since the picture element electrode for an echo and the picture element electrode for transparency are connected electrically, it is not necessary to prepare wiring for inputting a driving signal independently, and the configuration of a active-matrix substrate can be simplified.
[0071] Moreover, the picture element electrode for an echo is formed on a driver element, and it can prevent the light from the outside carrying out incidence to a driver element.
[0072] Moreover, the picture element electrode for transparency is not contributed to the brightness of a panel, when having switched off the back light, but in order to contribute to the brightness of a panel irrespective of burning of a back light, and putting out lights, the picture element electrode for an echo which reflects the light from the outside can stabilize the brightness of a display by enlarging the area, when the light of a back light puts out the light, or also when brightness is low.
[0073] Moreover, the brightness of a display can be raised even if it does not raise the brightness of the back light itself, since the light from the back light covered with the picture element electrode for an echo, gate wiring, etc. can be brought together in the picture element electrode for transparency.
[0074] Moreover, since a flare comes out in the direction in which the light from the outside is reflected by the picture element electrode for an echo, an angle of visibility can be extended.
[0075] Moreover, there is no need of establishing independently the process which forms the picture element electrode for an echo, and a routing counter and a manufacturing cost are not made to increase.
[0076] Moreover, since it connects with gate wiring and an electric target and the picture element electrode for an echo is, stray capacity-ization can be prevented and auxiliary capacity can be formed between drain electrodes.
[0077] Moreover, since the same signal as the signal impressed to a counterelectrode is inputted into the picture element electrode for an echo, stray capacity-ization can be prevented.
[0078] Moreover, the auxiliary capacity of the electrical potential difference impressed to a picture element electrode can be formed using the picture element electrode for an echo.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

TECHNICAL FIELD

[Field of the Invention] This invention relates to the liquid crystal display equipped with the transparency viewing area and the reflective viewing area.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

PRIOR ART

[Description of the Prior Art] As a liquid crystal display, the active matrix liquid crystal display in which the thin film transistor (TFT) or MIM component constituted by the amorphous silicon was formed on the substrate is known with gate wiring of every two or more which crosses mutually, and data wiring.
[0003] There are a transparency mold liquid crystal display which uses a back light as the light source, and a reflective mold liquid crystal display which reflects an external light and is used for a display in this active-matrix substrate.
[0004] In these active matrix liquid crystal displays, the transparency mold liquid crystal display and reflective mold liquid crystal display of high numerical aperture structure which make a picture element electrode superimpose on gate wiring and data wiring through an interlayer insulation film are developed, using organic materials, such as photosensitive transparence acrylic resin, as an interlayer insulation film.
[0005] Drawing 8 (a) is the top view of the reflective mold liquid crystal display of the high numerical aperture structure where the organic compound insulator was used as an interlayer insulation film, and drawing 8 (b) is the sectional view showing the F-F cross section of drawing 8 (a).
[0006] The active matrix liquid crystal indicating equipment shown in drawing 8 is equipped with the gate wiring 1, the data wiring 2, a driver element 3, the drain electrode 4, the auxiliary capacity electrode 5, gate dielectric film 6, the insulating substrate 7, a contact hole 8, an interlayer insulation film 9, the picture element electrode 10 for reflection, and the auxiliary capacity wiring 12.
[0007] It can consider as a transparency mold liquid crystal display by using as the electrode of transparence the picture element electrode 10 for reflection of the active matrix liquid crystal display shown in drawing 8 .
[0008] In order to reduce the capacity generated by making a picture element electrode superimpose on gate wiring and data wiring through an interlayer insulation film 9 as an ingredient of the interlayer insulation film 9 used for this high numerical aperture structure, it is required that forming by the thickness of several micrometers is easy, that a dielectric constant should be small as compared with silicon nitride etc., etc., and the organic compound insulator is used.
[0009] Moreover, although it is necessary to form a contact hole in an interlayer insulation film 9 in order to form this high numerical aperture structure, and to take electric contact of the drain electrode 4 arranged by the lower layer of an interlayer insulation film 9, and the picture element electrode arranged in the upper layer of an interlayer insulation film 9 After applying a liquefied resin ingredient to a substrate by the spin applying method by using photosensitive acrylic resin as an interlayer insulation film 9, Since it can expose at a FOTORISO process, patterning can be carried out by performing development by the alkaline solution and a contact hole can be formed, it is possible to perform membrane formation and patterning to coincidence.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

EFFECT OF THE INVENTION

[Effect of the Invention] According to this invention, the active matrix liquid crystal display which can change a reflective mold and a transparency mold can be formed.
[0068] Though sufficient brightness is taken out with any operating conditions when a user changes reflection to transparency according to an operating condition by this, a liquid crystal display that there is little power consumption and usable for a long time is realizable.
[0069] moreover, the transparency reflection which uses as a reflective mold liquid crystal display in a bright place, turns on a back light in a dark place and can be used as a transparency mold liquid crystal display -- formation of a switchable active matrix liquid crystal indicating equipment is attained.
[0070] Moreover, since the picture element electrode for reflection and the picture element electrode for transparency are connected electrically, it is not necessary to prepare wiring for inputting a driving signal separately, and the configuration of a active-matrix substrate can be simplified.
[0071] Moreover, the picture element electrode for reflection is formed on a driver element, and it can prevent the light from the outside carrying out incidence to a driver element.
[0072] Moreover, the picture element electrode for transparency is not contributed to the brightness of a panel, when having switched off the back light, but in order to contribute to the brightness of a panel irrespective of lighting of a back light, and putting out lights, the picture element electrode for reflection which reflects the light from the outside can stabilize the brightness of a display by enlarging the area, when the light of a back light puts out the light, or also when brightness is low.
[0073] Moreover, the brightness of a display can be raised even if it does not raise the brightness of the back light itself, since the light from the back light covered with the picture element electrode for reflection, gate wiring, etc. can be brought together in the picture element electrode for transparency.

[0074] Moreover, since a flare comes out in the direction in which the light from the outside is reflected by the picture element electrode for reflection, an angle of visibility can be extended.
[0075] Moreover, there is no need of establishing independently the process which forms the picture element electrode for reflection, and a routing counter and a manufacturing cost are not made to increase.
[0076] Moreover, since it connects with gate wiring electrically and the picture element electrode for reflection is, stray capacity-ization can be prevented and auxiliary capacity can be formed between drain electrodes.
[0077] Moreover, since the same signal as the signal impressed to a counterelectrode is inputted into the picture element electrode for reflection, stray capacity-ization can be prevented.
[0078] Moreover, the auxiliary capacity of the electrical potential difference impressed to a picture element electrode can be formed using the picture element electrode for reflection.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] In order that the transparency mold liquid crystal display which uses the light from a back light for a display might use a back light, there was much power consumption, and when a dc-battery was used, it had the trouble that continuous duty time amount was short.
[0011] Moreover, although there was little power consumption and it had the advantage in which continuous duty time amount was long since a back light was not used for a reflective mold liquid crystal display, reflectivity was not enough and there was a trouble of being hard to use it in a dark place.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

MEANS

[Means for Solving the Problem] Two or more gate wiring with which this invention was prepared on the insulating substrate and this insulating substrate, The driver element prepared in the intersection of two or more data wiring which intersects this gate wiring, and this gate wiring and this data wiring, The active-matrix substrate which has the picture element electrode electrically connected to this driver element, In the active matrix liquid crystal display which has the liquid crystal layer which intervened between the opposite substrate with which the counterelectrode was formed, and said active-matrix substrate and said opposite substrate, and a back light Said picture element electrode is characterized by having a picture element electrode for reflection, and a picture element electrode for transparency.
[0013] the transparency reflection which according to this invention uses as a reflective mold liquid crystal display in a bright place, turns on a back light in a dark place and can be used as a transparency mold liquid crystal display -- formation of a switchable active matrix liquid crystal indicating equipment is attained.
[0014] Moreover, this invention is characterized by connecting electrically said picture element electrode for reflection, and said picture element electrode for transparency.
[0015] Since the picture element electrode for reflection and the picture element electrode for transparency are connected electrically, it is not necessary to prepare wiring for inputting a driving signal separately, and according to this invention, the configuration of a active-matrix substrate can be simplified.
[0016] Moreover, this invention is characterized by forming said picture element electrode for reflection in the upper part of said driver element.
[0017] According to this invention, the picture element electrode for reflection is formed on a driver element, and it can prevent the light from the outside carrying out incidence to a driver element.
[0018] Moreover, this invention is characterized by making larger than the area of the part which penetrates the light of a back light with said picture element electrode for transparency area of the part which reflects an external light with said picture element electrode for reflection.
[0019] According to this invention, the picture element electrode for transparency is not contributed to the brightness of a panel, when having switched off the back light, but in order to contribute to the brightness of a panel irrespective of lighting of a back light, and putting out lights, the picture element electrode for reflection which reflects the light from the outside can stabilize the brightness of a display by enlarging the area, when the light of a back light puts out the light, or also when brightness is low.
[0020] Moreover, this invention is characterized by preparing a micro lens between said active-matrix substrates and said back lights.
[0021] The brightness of a display can be raised even if it does not raise the brightness of the back light itself, since the light from the back light covered with the picture element electrode for reflection, gate wiring, etc. can be brought together in the picture element electrode for transparency according to this invention.
[0022] Moreover, this invention is characterized by having formed the interlayer insulation film which has a ramp or concave heights on said drain electrode, and forming said picture element electrode for reflection on this interlayer insulation film.
[0023] Since a flare comes out in the direction in which the light from the outside is reflected by the

picture element electrode for reflection according to this invention, an angle of visibility can be extended.
[0024] Moreover, this invention is characterized by forming said picture element electrode for reflection in the same layer as said gate wiring or said data wiring.
[0025] According to this invention, there is no need of establishing independently the process which forms the picture element electrode for reflection, and a routing counter and a manufacturing cost are not made to increase.
[0026] Moreover, this invention is characterized by connecting electrically gate wiring of the picture element which adjoined said picture element electrode for reflection formed in the same layer as said gate wiring.
[0027] According to this invention, since it connects with gate wiring electrically and the picture element electrode for reflection is, stray capacity-ization can be prevented and auxiliary capacity can be formed between drain electrodes.
[0028] Moreover, this invention is characterized by inputting the same signal as the signal impressed to said counterelectrode into said picture element electrode for reflection formed in the same layer as said gate wiring.
[0029] Since the same signal as the signal impressed to a counterelectrode is inputted into the picture element electrode for reflection according to this invention, stray capacity-ization can be prevented.
[0030] Moreover, this invention is characterized by superimposing said picture element electrode for reflection and drain electrode, or the picture element electrode for transparency formed in the same layer as said gate wiring, and forming auxiliary capacity.
[0031] According to this invention, the auxiliary capacity of the electrical potential difference impressed to a picture element electrode can be formed using the picture element electrode for reflection.
[0032]
[Embodiment of the Invention] (Operation gestalt 1) Drawing 1 (a) shows the top view of the active-matrix substrate of the operation gestalt 1 of this invention, and drawing 1 (b) shows the sectional view of the A-A cross section of drawing 1 (a).
[0033] The active-matrix substrate is equipped with the gate wiring 1, the data wiring 2, a driver element 3, the drain electrode 4, the auxiliary capacity electrode 5, gate dielectric film 6, the insulating substrate 7, the contact hole 8, the interlayer insulation film 9, the picture element electrode 10 for reflection, and the picture element electrode 11 for transparency.
[0034] It connects as electrically as the drain electrode 4, and the auxiliary capacity electrode 5 is superimposed on the gate wiring 1 through gate dielectric film 6, and forms auxiliary capacity.
[0035] The contact hole 8 is established in the interlayer insulation film 9, in order to connect the picture element electrode 11 for transparency, and the auxiliary capacity electrode 5.
[0036] This active-matrix substrate is equipped with the picture element electrode 10 for reflection, and the picture element electrode 11 for transparency into one picture element, and as shown in drawing 2 , it forms picture element electrode 10 part for reflection which reflects the light from the outside into one picture element, and picture element electrode 11 part for transparency which penetrates the light of a back light.
[0037] Drawing 2 is the sectional view showing the liquid crystal display using the active-matrix substrate shown in drawing 1 , and has the data wiring 2, the drain electrode 4, gate dielectric film 6, the insulating substrate 7, an interlayer insulation film 9, the picture element electrode 10 for reflection, the picture element electrode 11 for transparency, the color filter layer 13, a counterelectrode 14, the liquid crystal layer 15, the orientation film 16, the polarizing plate 17, and the back light 18.
[0038] It is more desirable to make area of picture element electrode 10 part for reflection larger than picture element electrode 11 part for transparency, in order that picture element electrode 10 part for reflection which reflects the light from the outside may contribute to the brightness of a panel irrespective of lighting of a back light and putting out lights, although picture element electrode 11 part for transparency which penetrates the light of a back light 18 does not contribute to the brightness of a panel when having switched off the back light.
[0039] Although the picture element electrode 10 for reflection was formed on the picture element

electrode 11 for transparency and it has connected electrically with this operation gestalt in order to input the same signal as the picture element electrode 10 for reflection, and the picture element electrode 11 for transparency, the picture element electrode 10 for reflection and the picture element electrode 11 for transparency may not be connected electrically, but another signal may be inputted into each, and a separate display may be performed.
[0040] The light from the back light 18 by which incidence is carried out to the field in which the picture element electrode 10 for reflection was formed in the liquid crystal display of drawing 2 Since it cannot use as a display light, as shown in the sectional view of the liquid crystal display shown in drawing 3 , a micro lens 19 and the micro-lens protective layer 20 are formed between a back light 18 and a liquid crystal display panel. Make the field of the picture element electrode 11 for transparency in which the picture element electrode 10 for reflection is not formed of a micro lens 19 condense back light light, the amount of the light which penetrates the picture element electrode 11 for transparency is made to increase, and the brightness of a display can be raised.
[0041] Drawing 4 (a) shows the top view of the active-matrix substrate of other examples of this operation gestalt, and the sectional view of the B-B cross section of drawing 4 (a) is shown, drawing 4 (b) may be reversing the field of the picture element electrode 10 for reflection, and the picture element electrode 11 for transparency to drawing 1 , and it may change suitably the surface ratio of the picture element electrode 10 for reflection, and the picture element electrode 11 for transparency.

[0042] When the active-matrix substrate of drawing 1 is compared with the active-matrix substrate of drawing 4 , since the direction of the active-matrix substrate of drawing 1 forms the picture element electrode 10 for reflection on a driver element 3, and it can prevent the light from the outside carrying out incidence to a driver element 3 and it is arranged in the center whose picture element electrode 11 for transparency is a picture element, it is easy to form the micro lens 19 for condensing.
[0043] In this invention, although the way which gathers a numerical aperture as much as possible adopted high numerical aperture **** which intervened the interlayer insulation film 9 which consists of an organic compound insulator between a picture element electrode, the gate wiring 1, and source wiring 3 with ****** and this operation gestalt in order to form the part which reflects light into one picture element, and the part to penetrate, other structures may be used.
[0044] (Operation gestalt 2) Drawing 5 (a) shows the top view of the active-matrix substrate of the operation gestalt 2, and drawing 5 (b) shows the sectional view of the C-C cross section of drawing 5 (a).
[0045] The active matrix liquid crystal display of the operation gestalt 2 forms the picture element electrode 10 for reflection on the interlayer insulation film 9 in which a ramp or concave heights was formed, and since a flare comes out in the direction in which the light from the outside is reflected by the picture element electrode 10 for reflection, it can extend an angle of visibility.
[0046] Moreover, if an interlayer insulation film 9 is the thickest on the gate wiring 1 or the data wiring 2, and a ramp or concave heights is formed so that it may not form on the drain electrode 4, there is no need of forming the contact hole for taking electric contact of the drain electrode 4 and the picture element electrode 10, and since the orientation turbulence of the liquid crystal molecule generated for the steep level difference in the contact hole section can be prevented, a large numerical aperture can be taken.
[0047] The drain electrode 4 serves as the picture element electrode for transparency, and is a transparent electrode which consists of ITO etc.
[0048] Moreover, it is necessary to hold down the tilt angle of the ramp of an interlayer insulation film 9, or the concavo-convex pitch of concave heights to the include angle which is extent which can perform rubbing processing enough after forming the orientation film, and conditions [******] are used for it to each rubbing conditions and a liquid crystal molecule.
[0049] A micro lens can be prepared in drain electrode 4 part which served as the picture element electrode for transparency also in this operation gestalt, and the brightness at the time of back light lighting can be increased.
[0050] (Operation gestalt 3) Drawing 6 (a) shows the top view of the active-matrix substrate of the operation gestalt 3, and drawing 6 (b) shows the sectional view of the D-D cross section of drawing

6 (a).
[0051] In this operation gestalt, the picture element electrode 10 for reflection is formed in the same layer as the gate wiring 1 at the same process.
[0052] If it does in this way, there will be no need of establishing independently the process which forms the picture element electrode 10 for reflection, and a routing counter and a manufacturing cost will not be made to increase.
[0053] In the case of this operation gestalt, the picture element electrode 10 for reflection is not connected with the drain electrode 4 of a driver element 3, but it is used only for reflecting the light from the outside, and the picture element electrode 11 for transparency performs a role of an electrode for driving liquid crystal.
[0054] Namely, control of the permeability of light which the picture element electrode 10 for reflection reflected is performed by controlling a liquid crystal layer by the electrical potential difference of the picture element electrode 11 for transparency.
[0055] Under the present circumstances, if no signals are inputted into the picture element electrode 10 for reflection, since stray capacity will occur between the drain electrode 4 or the picture element electrode 11 for transparency, it is desirable to input into the picture element electrode 10 for reflection a signal which does not have a bad influence on a display, by connecting with the adjoining gate wiring 1, stray capacity-ization can be prevented and auxiliary capacity can be formed between the drain electrodes 4.
[0056] The brightness at the time of back light lighting can be increased by condensing to the picture element electrode for transparency by the micro lens also in this operation gestalt.
[0057] It is more desirable for this invention to also gather a numerical aperture as much as possible, in order to form the part which reflects light into one picture element, and the part to penetrate.
[0058] So, other structures may be used although the high numerical aperture structure which used the organic compound insulator for the interlayer insulation film was adopted as a configuration of this operation gestalt.
[0059] (Operation gestalt 4) The top view of the active-matrix substrate of the operation gestalt 4 is shown in drawing 7 (a), and the sectional view of the E-E cross section of drawing 7 (a) is shown in drawing 7 (b).
[0060] This operation gestalt forms the picture element electrode 10 for reflection in the same layer as the data wiring 2.
[0061] If it does in this way, in case the data wiring 2 is formed, the picture element electrode 10 for reflection can be formed, and a routing counter and a manufacturing cost will not be made to increase.
[0062] Since the high numerical aperture structure which minded the interlayer insulation film 9 also in the case of this operation gestalt is adopted, it is used only for the picture element electrode 10 for reflection reflecting the light from the outside like the operation gestalt 3, and only the picture element electrode 11 for transparency performs a role of an electrode for driving a liquid crystal molecule.
[0063] That this operation gestalt differs from the operation gestalt 3 here is a point currently formed in the form which the drain electrode 4 and the picture element electrode for reflection connected electrically, and when using the drain electrode 4 as a picture element electrode for transparency, without forming an interlayer insulation film 9, it also contributes the picture element electrode 10 for reflection to the drive of a liquid crystal molecule.
[0064] The brightness at the time of back light lighting can be increased by condensing to the picture element electrode 11 for transparency by the micro lens also in this operation gestalt.
[0065] It is more desirable to raise a numerical aperture also with this operation gestalt as much as possible, in order to form the part which reflects light into one picture element, and the part to penetrate.
[0066] So, other configurations may be used although the high numerical aperture structure which used the organic compound insulator for the interlayer insulation film was adopted as a configuration of this operation gestalt.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the top view and sectional view showing the active-matrix substrate of the operation gestalt 1 of this invention.
[Drawing 2] It is the sectional view showing the active-matrix substrate of the operation gestalt 1 of this invention.
[Drawing 3] It is the sectional view showing the active-matrix substrate equipped with the micro lens of this invention.
[Drawing 4] It is the top view and sectional view showing other examples of the active-matrix substrate of the operation gestalt 1 of this invention.
[Drawing 5] It is the top view and sectional view showing the active-matrix substrate of the operation gestalt 2 of this invention.
[Drawing 6] It is the top view and sectional view showing the active-matrix substrate of the operation gestalt 3 of this invention.
[Drawing 7] It is the top view and sectional view showing the active-matrix substrate of the operation gestalt 4 of this invention.
[Drawing 8] It is the sectional view showing the conventional liquid crystal display.
[Description of Notations]
1 Gate Wiring
2 Data Wiring
3 Driver Element
4 Drain Electrode
5 Auxiliary Capacity Electrode
6 Gate Dielectric Film
7 Insulating Substrate
8 Contact Hole
9 Interlayer Insulation Film
10 Picture Element Electrode for Reflection
11 Picture Element Electrode for Transparency
12 Auxiliary Capacity Wiring
13 Color Filter Layer
14 Counterelectrode
15 Liquid Crystal Layer
16 Orientation Film
17 Polarizing Plate
18 Back Light
19 Micro Lens
20 Micro-Lens Protective Layer

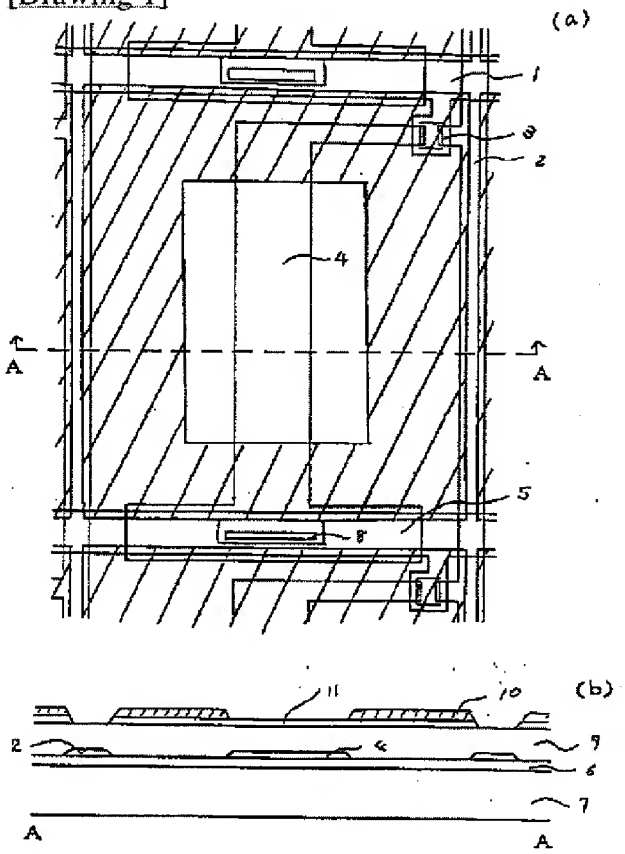
[Translation done.]

* NOTICES *

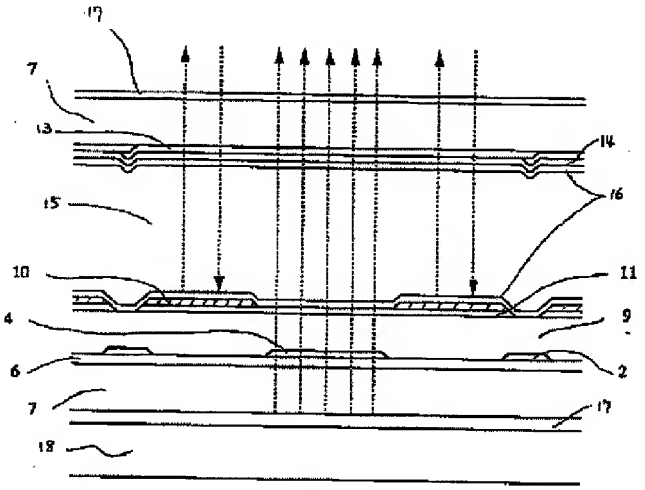
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

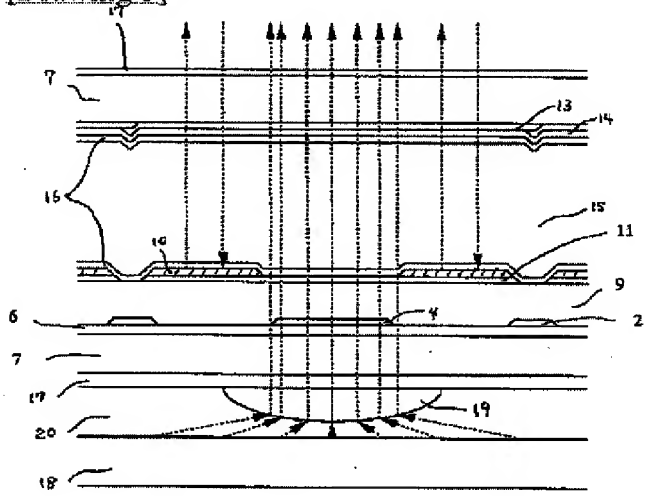
[Drawing 1]



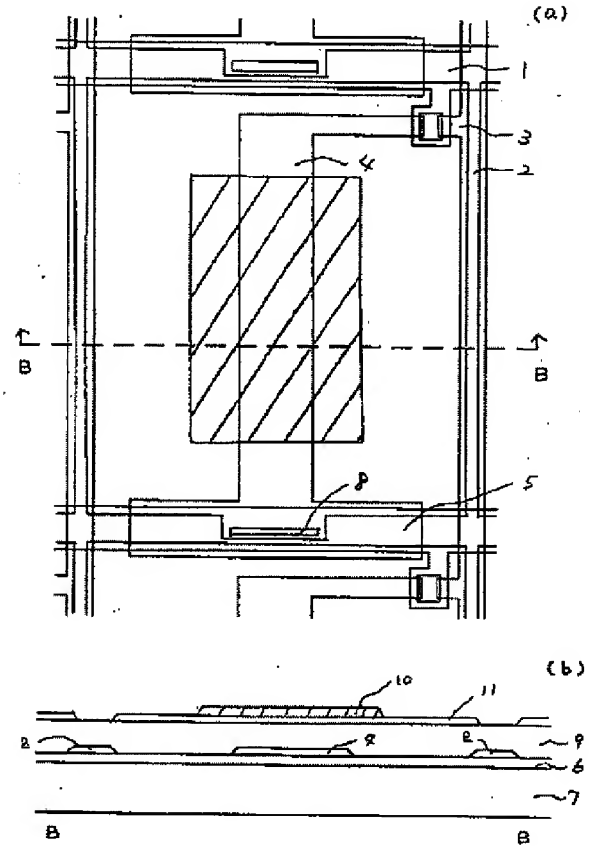
[Drawing 2]



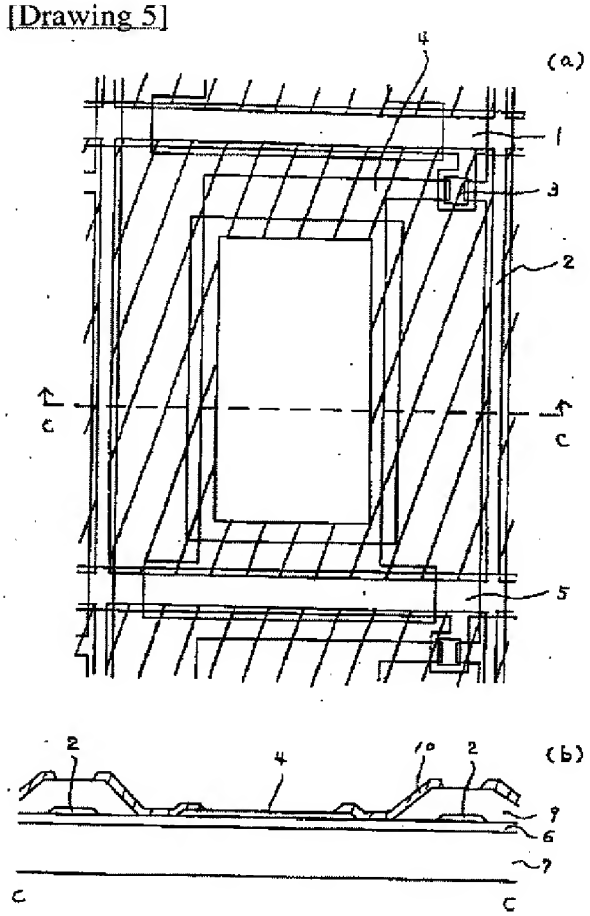
[Drawing 3]



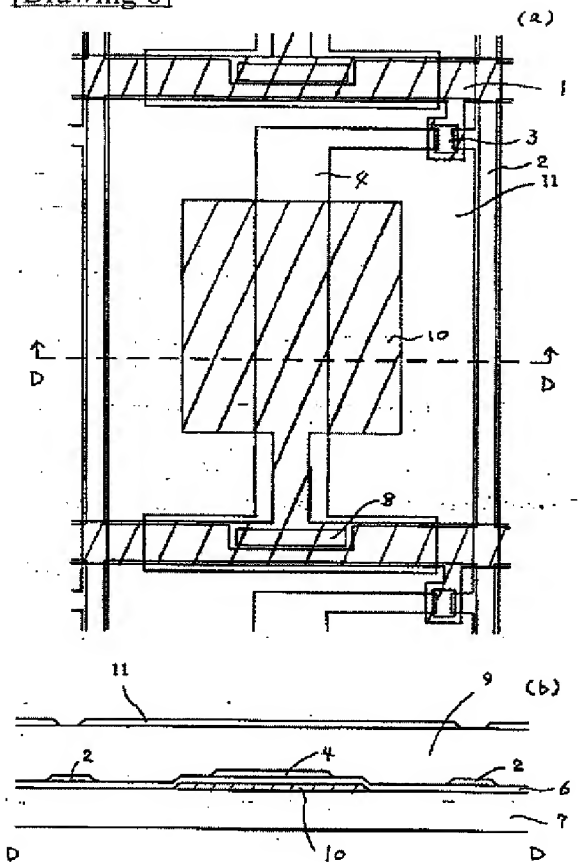
[Drawing 4]



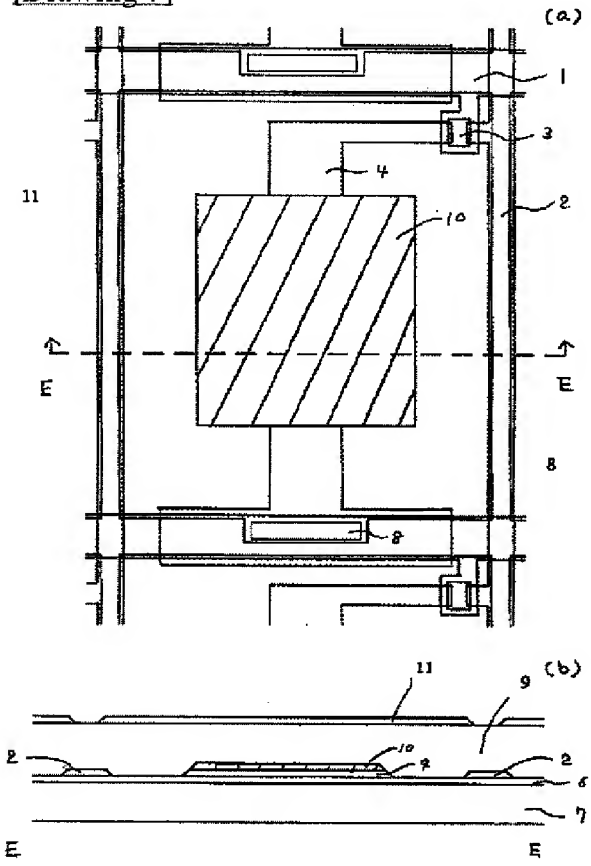
[Drawing 5]



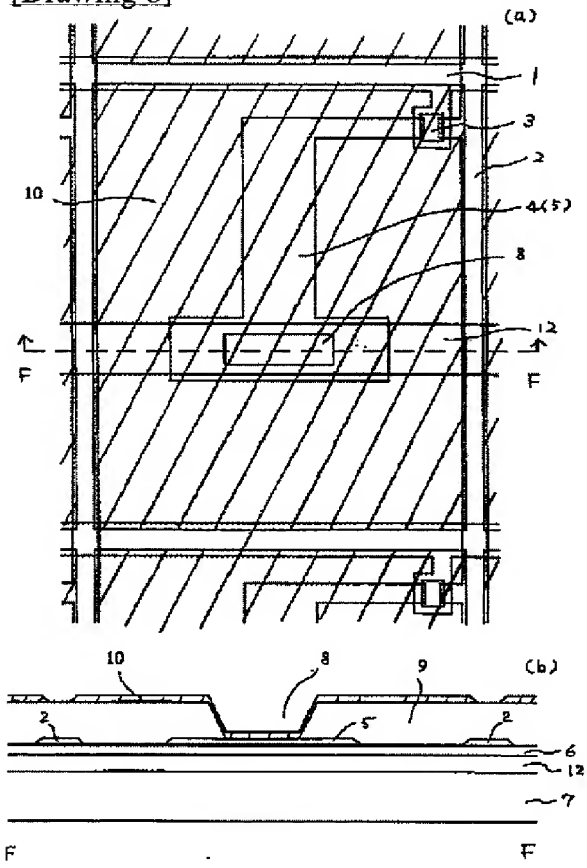
[Drawing 6]



[Drawing 7]



[Drawing 8]



[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CORRECTION OR AMENDMENT

[Kind of official gazette] Printing of amendment by the convention of 2 of Article 17 of Patent Law
[Section partition] The 2nd partition of the 6th section
[Publication date] July 3, Heisei 15 (2003. 7.3)

[Publication No.] JP,2002-258300,A (P2002-258300A)
[Date of Publication] September 11, Heisei 14 (2002. 9.11)
[Annual volume number] Open patent official report 14-2583
[Application number] Application for patent 2001-399153 (P2001-399153)
[The 7th edition of International Patent Classification]

G02F 1/1343

[FI]

G02F 1/1343

[Procedure revision]
[Filing Date] April 2, Heisei 15 (2003. 4.2)
[Procedure amendment 1]
[Document to be Amended] Specification
[Item(s) to be Amended] Claim
[Method of Amendment] Modification
[Proposed Amendment]
[Claim(s)]
[Claim 1] An insulating substrate, two or more gate wiring prepared on this insulating substrate, and two or more data wiring which intersects this gate wiring, The active-matrix substrate which has the driver element prepared in the intersection of this gate wiring and this data wiring, and the picture element electrode electrically connected to this driver element, In the active matrix liquid crystal display which has the liquid crystal layer which intervened between the opposite substrate with which the counterelectrode was formed, and said active-matrix substrate and said opposite substrate, and a back light,
Said picture element electrode is an active matrix liquid crystal display characterized by having a picture element electrode for reflection, and a picture element electrode for transparency, and dividing and forming a reflective viewing area and a transparency viewing area into one picture element.
[Claim 2] In the active matrix liquid crystal display which has the liquid crystal layer which intervened between the active-matrix substrate which has the picture element electrode electrically connected to the driver element, the opposite substrate with which the counterelectrode was formed, and said active-matrix substrate and said opposite substrate, and a back light,
The active matrix liquid crystal display characterized by dividing and forming a reflective viewing area and a transparency viewing area into one picture element.
[Procedure amendment 2]

[Document to be Amended] Specification
[Item(s) to be Amended] 0012
[Method of Amendment] Modification
[Proposed Amendment]
[0012]
[Means for Solving the Problem] An insulating substrate Two or more gate wiring prepared on this insulating substrate Two or more data wiring which intersects this gate wiring The driver element prepared in the intersection of this gate wiring and this data wiring The picture element electrode electrically connected to this driver element It is the active matrix liquid crystal display which has the liquid crystal layer which intervened between the active-matrix substrate equipped with the above, the opposite substrate with which the counterelectrode was formed, and said active-matrix substrate and said opposite substrate, and a back light, and said picture element electrode has a picture element electrode for reflection, and a picture element electrode for transparency, and is characterized by dividing and forming a reflective viewing area and a transparency viewing area into one picture element.
[Procedure amendment 3]
[Document to be Amended] Specification
[Item(s) to be Amended] 0013
[Method of Amendment] Modification
[Proposed Amendment]
[0013] Moreover, this invention is characterized by dividing and forming a reflective viewing area and a transparency viewing area into one picture element in the active matrix liquid crystal display which has the liquid crystal layer which intervened between the active-matrix substrate which has the picture element electrode electrically connected to the driver element, the opposite substrate with which the counterelectrode was formed, and said active-matrix substrate and said opposite substrate, and a back light.
[Procedure amendment 4]
[Document to be Amended] Specification
[Item(s) to be Amended] 0014
[Method of Amendment] Modification
[Proposed Amendment]
[0014] the transparency reflection which according to this invention uses as a reflective mold liquid crystal display in a bright place, turns on a back light in a dark place and can be used as a transparency mold liquid crystal display -- formation of a switchable active matrix liquid crystal indicating equipment is attained.
[Procedure amendment 5]
[Document to be Amended] Specification
[Item(s) to be Amended] 0015
[Method of Amendment] Deletion
[Procedure amendment 6]
[Document to be Amended] Specification
[Item(s) to be Amended] 0016
[Method of Amendment] Deletion
[Procedure amendment 7]
[Document to be Amended] Specification
[Item(s) to be Amended] 0017
[Method of Amendment] Deletion
[Procedure amendment 8]
[Document to be Amended] Specification
[Item(s) to be Amended] 0018
[Method of Amendment] Deletion
[Procedure amendment 9]
[Document to be Amended] Specification
[Item(s) to be Amended] 0019
[Method of Amendment] Deletion

[Procedure amendment 10]
[Document to be Amended] Specification
[Item(s) to be Amended] 0020
[Method of Amendment] Deletion
[Procedure amendment 11]
[Document to be Amended] Specification
[Item(s) to be Amended] 0021
[Method of Amendment] Deletion
[Procedure amendment 12]
[Document to be Amended] Specification
[Item(s) to be Amended] 0022
[Method of Amendment] Deletion
[Procedure amendment 13]
[Document to be Amended] Specification
[Item(s) to be Amended] 0023
[Method of Amendment] Deletion
[Procedure amendment 14]
[Document to be Amended] Specification
[Item(s) to be Amended] 0024
[Method of Amendment] Deletion
[Procedure amendment 15]
[Document to be Amended] Specification
[Item(s) to be Amended] 0025
[Method of Amendment] Deletion
[Procedure amendment 16]
[Document to be Amended] Specification
[Item(s) to be Amended] 0026
[Method of Amendment] Deletion
[Procedure amendment 17]
[Document to be Amended] Specification
[Item(s) to be Amended] 0027
[Method of Amendment] Deletion
[Procedure amendment 18]
[Document to be Amended] Specification
[Item(s) to be Amended] 0028
[Method of Amendment] Deletion
[Procedure amendment 19]
[Document to be Amended] Specification
[Item(s) to be Amended] 0029
[Method of Amendment] Deletion
[Procedure amendment 20]
[Document to be Amended] Specification
[Item(s) to be Amended] 0030
[Method of Amendment] Deletion
[Procedure amendment 21]
[Document to be Amended] Specification
[Item(s) to be Amended] 0031
[Method of Amendment] Deletion
[Procedure amendment 22]
[Document to be Amended] Specification
[Item(s) to be Amended] 0070
[Method of Amendment] Deletion
[Procedure amendment 23]
[Document to be Amended] Specification
[Item(s) to be Amended] 0071

[Method of Amendment] Deletion
[Procedure amendment 24]
[Document to be Amended] Specification
[Item(s) to be Amended] 0072
[Method of Amendment] Deletion
[Procedure amendment 25]
[Document to be Amended] Specification
[Item(s) to be Amended] 0073
[Method of Amendment] Deletion
[Procedure amendment 26]
[Document to be Amended] Specification
[Item(s) to be Amended] 0074
[Method of Amendment] Deletion
[Procedure amendment 27]
[Document to be Amended] Specification
[Item(s) to be Amended] 0075
[Method of Amendment] Deletion
[Procedure amendment 28]
[Document to be Amended] Specification
[Item(s) to be Amended] 0076
[Method of Amendment] Deletion
[Procedure amendment 29]
[Document to be Amended] Specification
[Item(s) to be Amended] 0077
[Method of Amendment] Deletion
[Procedure amendment 30]
[Document to be Amended] Specification
[Item(s) to be Amended] 0078
[Method of Amendment] Deletion

[Translation done.]

(19)日本国特許庁（ＪＰ）　(12) **公開特許公報（Ａ）**　(11)特許出願公開番号
特開2002－258300
（P2002－258300A）
(43)公開日　平成14年９月11日(2002.9.11)

(51)Int.Cl.'	識別記号	ＦＩ	ﾃｰﾏｺｰﾄﾞ(参考)
Ｇ０２Ｆ　1/1343		Ｇ０２Ｆ　1/1343	２Ｈ０９２

審査請求　有　　請求項の数１　ＯＬ　（全８頁）

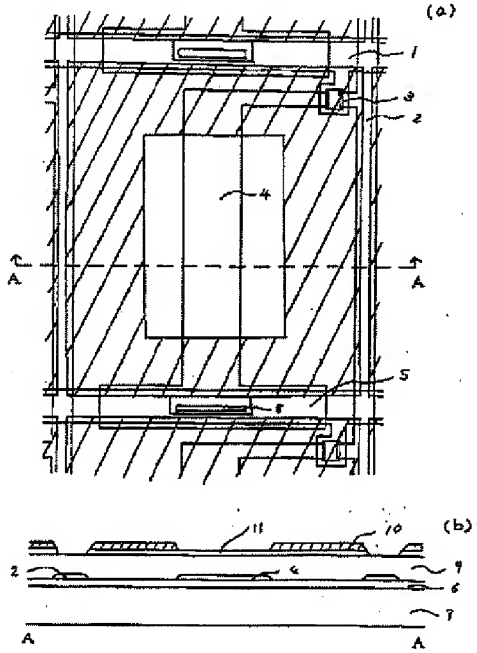
(21)出願番号　特願2001－399153(P2001－399153)
(62)分割の表示　特願平9－274327の分割
(22)出願日　平成９年10月７日(1997.10.7)

(71)出願人　000005049
シャープ株式会社
大阪府大阪市阿倍野区長池町22番22号
(72)発明者　錦　博彦
大阪府大阪市阿倍野区長池町22番22号　シャープ株式会社内
(74)代理人　100103296
弁理士　小池　隆彌　（外１名）

Ｆターム(参考)　2H092 GA13 GA17 GA19 JA03 JA24 JA42 JA46 JB08 JB13 JB58 JB64 NA01 NA26 PA07 PA13

(54)【発明の名称】　アクティブマトリクス型液晶表示装置

(57)【要約】
【課題】　液晶表示装置において、明るい場所では消費電力が少なく、暗い場所で十分な表示輝度を有する表示状態を得ること目的とする。
【解決手段】　このアクティブマトリクス基板は一つの絵素の中に反射用絵素電極１０と透過用絵素電極１１を備えており、図２に示すように、一つの絵素の中に外部からの光を反射する反射用絵素電極１０部分とバックライトの光を透過する透過用絵素電極１１部分を形成している。



【特許請求の範囲】

【請求項１】　絶縁性基板と、該絶縁性基板上に設けられた複数のゲート配線と、該ゲート配線と交差する複数のデータ配線と、該ゲート配線と該データ配線との交差部に設けられた駆動素子と、該駆動素子に電気的に接続された絵素電極とを有するアクティブマトリクス基板と、対向電極が形成された対向基板と、前記アクティブマトリクス基板と前記対向基板との間に介在された液晶層と、バックライトとを有するアクティブマトリクス型液晶表示装置において、前記絵素電極は、反射用絵素電極と透過用絵素電極とを有することを特徴とするアクティブマトリクス型液晶表示装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、透過表示領域と反射表示領域を備えた液晶表示装置に関するものである。

【０００２】

【従来の技術】液晶表示装置としては、互いに交差する複数本ずつのゲート配線とデータ配線とともに、アモルファスＳｉにより構成した薄膜トランジスタ（ＴＦＴ）或いはＭＩＭ素子を基板上に形成したアクティブマトリクス型液晶表示装置が知られている。

【０００３】このアクティブマトリクス基板には、光源としてバックライトを利用する透過型液晶表示装置と、外部の光を反射して表示に利用する反射型液晶表示装置がある。

【０００４】これらのアクティブマトリクス型液晶表示装置において、感光性透明アクリル樹脂などの有機材料を層間絶縁膜として用い、ゲート配線及びデータ配線に絵素電極を層間絶縁膜を介して重畳させる高開口率構造の透過型液晶表示装置や反射型液晶表示装置が開発されている。

【０００５】図８（ａ）は、層間絶縁膜として有機絶縁膜を用いた高開口率構造の反射型液晶表示装置の平面図であり、図８（ｂ）は、図８（ａ）のＦ－Ｆ断面を示す断面図である。

【０００６】図８に示すアクティブマトリクス型液晶表示装置は、ゲート配線１、データ配線２、駆動素子３、ドレイン電極４、補助容量電極５、ゲート絶縁膜６、絶縁性基板７、コンタクトホール８、層間絶縁膜９、反射用絵素電極１０、補助容量配線１２とを備えている。

【０００７】図８に示すアクティブマトリクス型液晶表示装置の反射用絵素電極１０を透明の電極とすることにより透過型液晶表示装置とすることができる。

【０００８】この高開口率構造に使用する層間絶縁膜９の材料としては、層間絶縁膜９を介して絵素電極をゲート配線及びデータ配線に重畳させることにより発生する容量を低減するために、数μｍの厚さで形成することが容易であること、誘電率が窒化シリコン等と比較して小さいこと等が要求されており、有機絶縁膜が用いられている。

【０００９】また、この高開口率構造を形成する為には、層間絶縁膜９の下層に配設されたドレイン電極４と層間絶縁膜９の上層に配設された絵素電極の電気的接触を取るために、層間絶縁膜９にコンタクトホールを形成する必要があるが、感光性アクリル樹脂を層間絶縁膜９として用いることにより、液状の樹脂材料をスピン塗布法により基板に塗布した後、フォトリソ工程にて露光し、アルカリ性溶液による現像を行うことによりパターニングし、コンタクトホールを形成することができるので、成膜とパターニングを同時に行うことが可能である。

【００１０】

【発明が解決しようとする課題】バックライトからの光を表示に利用する透過型液晶表示装置はバックライトを使用するため消費電力が多く、バッテリーを使用する場合、連続使用時間が短いという問題点があった。

【００１１】また反射型液晶表示装置は、バックライトを使用しないため消費電力が少なく、連続使用時間が長いという長所を持っているが、反射強度が十分ではなく、暗いところでは使用しにくいという問題点があった。

【００１２】

【課題を解決するための手段】本発明は、絶縁性基板と、該絶縁性基板上に設けられた複数のゲート配線と、該ゲート配線と交差する複数のデータ配線と、該ゲート配線と該データ配線との交差部に設けられた駆動素子と、該駆動素子に電気的に接続された絵素電極とを有するアクティブマトリクス基板と、対向電極が形成された対向基板と、前記アクティブマトリクス基板と前記対向基板との間に介在された液晶層と、バックライトとを有するアクティブマトリクス型液晶表示装置において、前記絵素電極は、反射用絵素電極と透過用絵素電極とを有することを特徴とする。

【００１３】本発明によれば、明るいところでは反射型液晶表示装置として使用し、暗い所ではバックライトを点灯し透過型液晶表示装置として使用できる透過反射切り替え可能なアクティブマトリクス型液晶表示装置の形成が可能となる。

【００１４】また、本発明は、前記反射用絵素電極と前記透過用絵素電極を電気的に接続することを特徴とする。

【００１５】本発明によれば、反射用絵素電極と透過用絵素電極とを電気的に接続しているため別々に駆動信号を入力するための配線を設ける必要がなく、アクティブマトリクス基板の構成を簡略化できる。

【００１６】また、本発明は、前記駆動素子の上部に前記反射用絵素電極を形成することを特徴とする。

【００１７】本発明によれば、駆動素子の上に反射用絵素電極を形成しており、外部からの光が駆動素子に入射

することを防ぐことができる。

【0018】また、本発明は、前記反射用絵素電極によって外部の光を反射する部分の面積を、前記透過用絵素電極によってバックライトの光を透過する部分の面積よりも大きくすることを特徴とする。

【0019】本発明によれば、透過用絵素電極は、バックライトを消灯しているときはパネルの輝度に寄与しないが、外部からの光を反射する反射用絵素電極はバックライトの点灯、消灯にかかわらずパネルの輝度に寄与するため、その面積を大きくすることにより、バックライトの光が消灯したときや輝度が低いときにも表示の輝度を安定させることができる。

【0020】また、本発明は、前記アクティブマトリクス基板と前記バックライトの間にマイクロレンズを設けたことを特徴とする。

【0021】本発明によれば、反射用絵素電極やゲート配線等により遮蔽されるバックライトからの光を透過用絵素電極に集めることができるため、バックライト自体の輝度を高めなくても、表示装置の輝度を高めることができる。

【0022】また、本発明は前記ドレイン電極上に傾斜部又は凹凸部をもつ層間絶縁膜が形成され、該層間絶縁膜上に前記反射用絵素電極が形成されたことを特徴とする。

【0023】本発明によれば、反射用絵素電極によって外部からの光が反射される方向に拡がりが出るため、視野角を広げることができる。

【0024】また、本発明は、前記ゲート配線又は前記データ配線と同じ層に前記反射用絵素電極を形成することを特徴とする。

【0025】本発明によれば、反射用絵素電極を形成する工程を別に設ける必要が無く、工程数及び製造コストを増加させることが無い。

【0026】また、本発明は、前記ゲート配線と同じ層に形成された前記反射用絵素電極と隣接した絵素のゲート配線を電気的に接続することを特徴とする。

【0027】本発明によれば、反射用絵素電極がゲート配線と電気的に接続されいるため、浮遊容量化を防ぐことができ、ドレイン電極との間に補助容量を形成することができる。

【0028】また、本発明は、前記ゲート配線と同じ層に形成された前記反射用絵素電極に前記対向電極に印加される信号と同じ信号を入力することを特徴とする。

【0029】本発明によれば、反射用絵素電極に対向電極に印加される信号と同じ信号が入力されるため、浮遊容量化を防ぐことができる。

【0030】また、本発明は、前記ゲート配線と同じ層に形成された前記反射用絵素電極とドレイン電極又は透過用絵素電極を重畳して補助容量を形成することを特徴とする。

【0031】本発明によれば、絵素電極に印加される電圧の補助容量を反射用絵素電極を利用して形成することができる。

【0032】

【発明の実施の形態】（実施形態１）図１（ａ）は本発明の実施形態１のアクティブマトリクス基板の平面図を示し、図１（ｂ）は図１（ａ）のＡ－Ａ断面の断面図を示す。

【0033】アクティブマトリクス基板は、ゲート配線１、データ配線２、駆動素子３、ドレイン電極４、補助容量電極５、ゲート絶縁膜６、絶縁性基板７、コンタクトホール８、層間絶縁膜９、反射用絵素電極１０と透過用絵素電極１１を備えている。

【0034】補助容量電極５は、ドレイン電極４と電気的に接続されており、ゲート絶縁膜６を介してゲート配線１と重畳し補助容量を形成している。

【0035】コンタクトホール８は、透過用絵素電極１１と補助容量電極５を接続するために層間絶縁膜９に設けられている。

【0036】このアクティブマトリクス基板は一つの絵素の中に反射用絵素電極１０と透過用絵素電極１１を備えており、図２に示すように、一つの絵素の中に外部からの光を反射する反射用絵素電極１０部分とバックライトの光を透過する透過用絵素電極１１部分を形成している。

【0037】図２は、図１に示すアクティブマトリクス基板を用いた液晶表示装置を示す断面図であり、データ配線２、ドレイン電極４、ゲート絶縁膜６、絶縁性基板７、層間絶縁膜９、反射用絵素電極１０、透過用絵素電極１１、カラーフィルター層１３、対向電極１４、液晶層１５、配向膜１６、偏光板１７、バックライト１８を有している。

【0038】バックライト１８の光を透過する透過用絵素電極１１部分は、バックライトを消灯しているときはパネルの輝度に寄与しないが、外部からの光を反射する反射用絵素電極１０部分はバックライトの点灯、消灯にかかわらずパネルの輝度に寄与するため、透過用絵素電極１１部分より反射用絵素電極１０部分の面積を大きくするほうが望ましい。

【0039】本実施形態では反射用絵素電極１０と透過用絵素電極１１に同じ信号を入力するために反射用絵素電極１０を透過用絵素電極１１の上に形成して電気的に接続しているが、反射用絵素電極１０と透過用絵素電極１１を電気的に接続せず、別の信号をそれぞれに入力し別々の表示を行ってもよい。

【0040】図２の液晶表示装置では反射用絵素電極１０が形成された領域に入射されるバックライト１８からの光は、表示光として利用できないため、図３に示す液晶表示装置の断面図のようにバックライト１８と液晶表示パネルの間にマイクロレンズ１９とマイクロレンズ保

護層２０を形成し、マイクロレンズ１９により反射用絵素電極１０が形成されていない透過用絵素電極１１の領域にバックライト光を集光させ、透過用絵素電極１１を透過する光の量を増加させ表示の輝度を高めることができる。

【００４１】図４（ａ）は本実施形態の他の例のアクティブマトリクス基板の平面図を示し、図４（ｂ）は図４（ａ）のＢ－Ｂ断面の断面図を示しており、図１に対して反射用絵素電極１０と透過用絵素電極１１の領域を逆転させており、反射用絵素電極１０と透過用絵素電極１１の面積比は適宜変更してもよい。

【００４２】図１のアクティブマトリクス基板と図４のアクティブマトリクス基板を比べた場合、図１のアクティブマトリクス基板の方が、駆動素子３の上に反射用絵素電極１０を形成しており、外部からの光が駆動素子３に入射することを防ぐことができ、また、透過用絵素電極１１が絵素の中央に配設されているため集光用のマイクロレンズ１９を形成しやすい。

【００４３】本発明では、一つの絵素の中に光を反射する部分と透過する部分を形成するために、できるだけ開口率を上げるほうが望まく、本実施形態では、絵素電極とゲート配線１及びソース配線３との間に有機絶縁膜からなる層間絶縁膜９を介在した高開口率構造を採用したが、他の構造を用いてもよい。

【００４４】（実施形態２）図５（ａ）は実施形態２のアクティブマトリクス基板の平面図を示し、図５（ｂ）は図５（ａ）のＣ－Ｃ断面の断面図を示す。

【００４５】実施形態２のアクティブマトリクス型液晶表示装置は、傾斜部又は凹凸部を形成した層間絶縁膜９上に反射用絵素電極１０を形成しており、反射用絵素電極１０によって外部からの光が反射される方向に拡がりが出るため、視野角を広げることができる。

【００４６】また層間絶縁膜９は、ゲート配線１やデータ配線２上で最も厚く、ドレイン電極４上には形成しないように傾斜部又は凹凸部を形成すると、ドレイン電極４と絵素電極１０の電気的接触を取るためのコンタクトホールを形成する必要が無く、コンタクトホール部での急峻な段差のために発生していた液晶分子の配向乱れを防ぐことができるため、開口率を大きく取れる。

【００４７】ドレイン電極４は透過用絵素電極を兼ねており、ＩＴＯ等からなる透明な電極である。

【００４８】また層間絶縁膜９の傾斜部の傾斜角又は凹凸部の凹凸ピッチは、配向膜を形成した上でラビング処理が十分行える程度の角度に抑える必要があり、各々のラビング条件及び液晶分子に対して最適化な条件を用いる。

【００４９】本実施形態においても透過用絵素電極を兼ねたドレイン電極４部分にマイクロレンズを設け、バックライト点灯時の輝度を増すことができる。

【００５０】（実施形態３）図６（ａ）は実施形態３のアクティブマトリクス基板の平面図を示し、図６（ｂ）は図６（ａ）のＤ－Ｄ断面の断面図を示す。

【００５１】本実施形態において、反射用絵素電極１０はゲート配線１と同じ層に同一工程で形成する。

【００５２】このようにすれば、反射用絵素電極１０を形成する工程を別に設ける必要が無く、工程数及び製造コストを増加させることが無い。

【００５３】本実施形態の場合、反射用絵素電極１０は、駆動素子３のドレイン電極４と接続されておらず、外部からの光を反射することのみに使われており、液晶を駆動するための電極としての役割は透過用絵素電極１１が行う。

【００５４】即ち、反射用絵素電極１０が反射した光の透過率の制御は、透過用絵素電極１１の電圧によって液晶層を制御して行う。

【００５５】この際、反射用絵素電極１０に何も信号を入力していないと、ドレイン電極４若しくは透過用絵素電極１１との間に浮遊容量が発生するため、反射用絵素電極１０には表示に悪影響を与えないような信号を入力することが望ましく、隣接したゲート配線１と接続することにより、浮遊容量化を防ぎ、ドレイン電極４との間に補助容量を形成することができる。

【００５６】本実施形態においてもマイクロレンズにより透過用絵素電極に集光することによりバックライト点灯時の輝度を増すことができる。

【００５７】本発明でも、一つの絵素の中に光を反射する部分と透過する部分を形成するためにできるだけ開口率を上げるほうが望ましい。

【００５８】それ故本実施形態の構成としては、有機絶縁膜を層間絶縁膜に使用した高開口率構造を採用したが、この他の構造を用いてもよい。

【００５９】（実施形態４）図７（ａ）には実施形態４のアクティブマトリクス基板の平面図を示し、図７（ｂ）には図７（ａ）のＥ－Ｅ断面の断面図を示す。

【００６０】本実施形態は反射用絵素電極１０をデータ配線２と同じ層に形成している。

【００６１】このようにすれば、データ配線２を形成する際に反射用絵素電極１０を形成することができ、工程数及び製造コストを増加させることが無い。

【００６２】本実施形態の場合でも層間絶縁膜９を介した高開口率構造を採用しているため、実施形態３と同様に反射用絵素電極１０は外部からの光を反射することのみに使われており、液晶分子を駆動するための電極としての役割は透過用絵素電極１１のみが行う。

【００６３】ここで本実施形態が実施形態３と異なるのは、ドレイン電極４と反射用絵素電極が電気的に接続した形で形成されている点であり、層間絶縁膜９を形成せずにドレイン電極４を透過用絵素電極として用いる場合には、反射用絵素電極１０も液晶分子の駆動に寄与する。

【００６４】本実施形態においてもマイクロレンズにより透過用絵素電極１１に集光することによりバックライト点灯時の輝度を増すことができる。

【００６５】本実施形態でも、一つの絵素の中に光を反射する部分と透過する部分を形成するためにできるだけ開口率を上げるほうが望ましい。

【００６６】それ故本実施形態の構成としては、有機絶縁膜を層間絶縁膜に使用した高開口率構造を採用したが、他の構成を用いてもよい。

【００６７】

【発明の効果】本発明によると反射型と透過型の切り替えが可能なアクティブマトリクス型液晶表示装置を形成できる。

【００６８】これにより使用者が使用状況に合わせて透過と反射を切り替えることにより、どのような使用状況でも十分な輝度を出しながらも、消費電力の少なく、長時間使用可能な液晶表示装置を実現できる。

【００６９】また、明るいところでは反射型液晶表示装置として使用し、暗いところではバックライトを点灯し透過型液晶表示装置として使用できる透過反射切り替え可能なアクティブマトリクス型液晶表示装置の形成が可能となる。

【００７０】また、反射用絵素電極と透過用絵素電極とを電気的に接続しているため別々に駆動信号を入力するための配線を設ける必要がなく、アクティブマトリクス基板の構成を簡略化できる。

【００７１】また、駆動素子の上に反射用絵素電極を形成しており、外部からの光が駆動素子に入射することを防ぐことができる。

【００７２】また、透過用絵素電極は、バックライトを消灯しているときはパネルの輝度に寄与しないが、外部からの光を反射する反射用絵素電極はバックライトの点灯、消灯にかかわらずパネルの輝度に寄与するため、その面積を大きくすることにより、バックライトの光が消灯したときや輝度が低いときにも表示の輝度を安定させることができる。

【００７３】また、反射用絵素電極やゲート配線等により遮蔽されるバックライトからの光を透過用絵素電極に集めることができるため、バックライト自体の輝度を高めなくても、表示装置の輝度を高めることができる。

【００７４】また、反射用絵素電極によって外部からの光が反射される方向に拡がりが出るため、視野角を広げることができる。

【００７５】また、反射用絵素電極を形成する工程を別に設ける必要が無く、工程数及び製造コストを増加させることが無い。

【００７６】また、反射用絵素電極がゲート配線と電気的に接続されいるため、浮遊容量化を防ぐことができ、ドレイン電極との間に補助容量を形成することができる。

【００７７】また、反射用絵素電極に対向電極に印加される信号と同じ信号が入力されるため、浮遊容量化を防ぐことができる。

【００７８】また、絵素電極に印加される電圧の補助容量を反射用絵素電極を利用して形成することができる。

【図面の簡単な説明】

【図１】本発明の実施形態１のアクティブマトリクス基板を示す平面図及び断面図である。

【図２】本発明の実施形態１のアクティブマトリクス基板を示す断面図である。

【図３】本発明のマイクロレンズを備えたアクティブマトリクス基板を示す断面図である。

【図４】本発明の実施形態１のアクティブマトリクス基板の他の例を示す平面図及び断面図である。

【図５】本発明の実施形態２のアクティブマトリクス基板を示す平面図及び断面図である。

【図６】本発明の実施形態３のアクティブマトリクス基板を示す平面図及び断面図である。

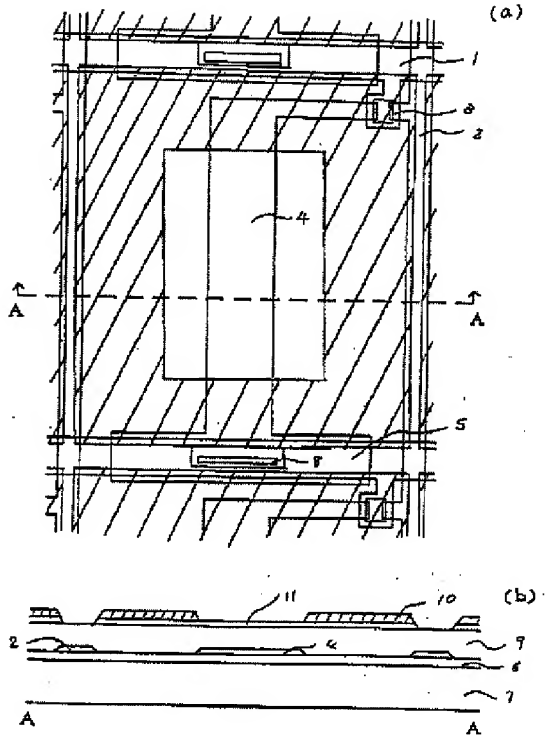
【図７】本発明の実施形態４のアクティブマトリクス基板を示す平面図及び断面図である。

【図８】従来の液晶表示装置を示す断面図である。

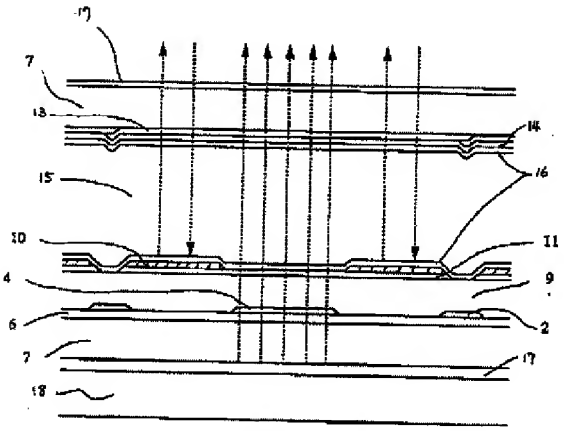
【符号の説明】

１　ゲート配線
２　データ配線
３　駆動素子
４　ドレイン電極
５　補助容量電極
６　ゲート絶縁膜
７　絶縁性基板
８　コンタクトホール
９　層間絶縁膜
１０　反射用絵素電極
１１　透過用絵素電極
１２　補助容量配線
１３　カラーフィルター層
１４　対向電極
１５　液晶層
１６　配向膜
１７　偏光板
１８　バックライト
１９　マイクロレンズ
２０　マイクロレンズ保護層

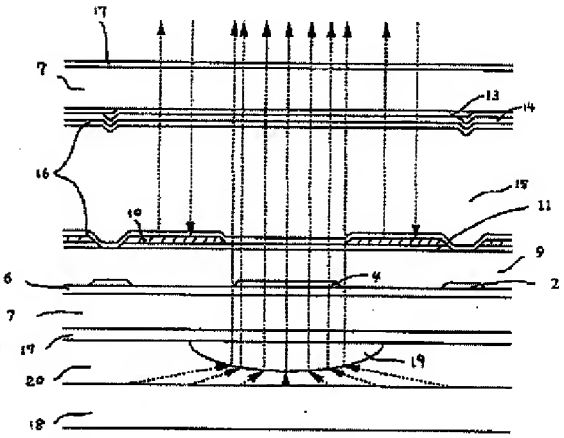
【図1】


(a)
1
8
2
4
A
A
5
(b)
11
10
2
9
6
7
A
A

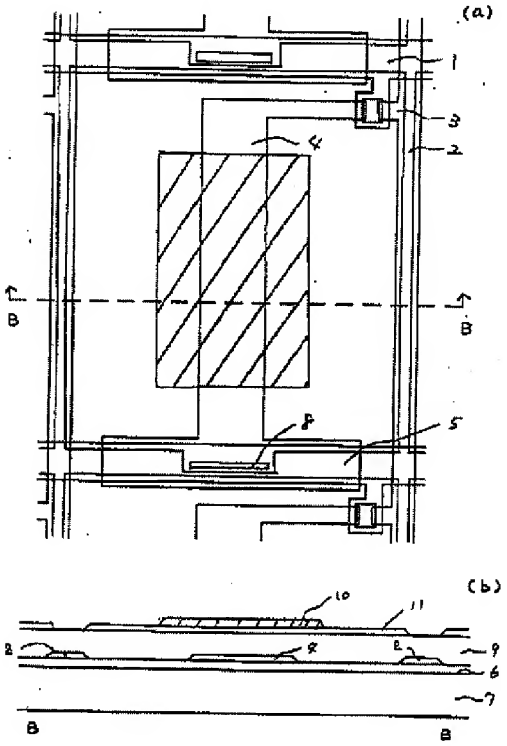
【図2】


17
7
13
14
15
16
10
11
4
9
6
2
7
17
18

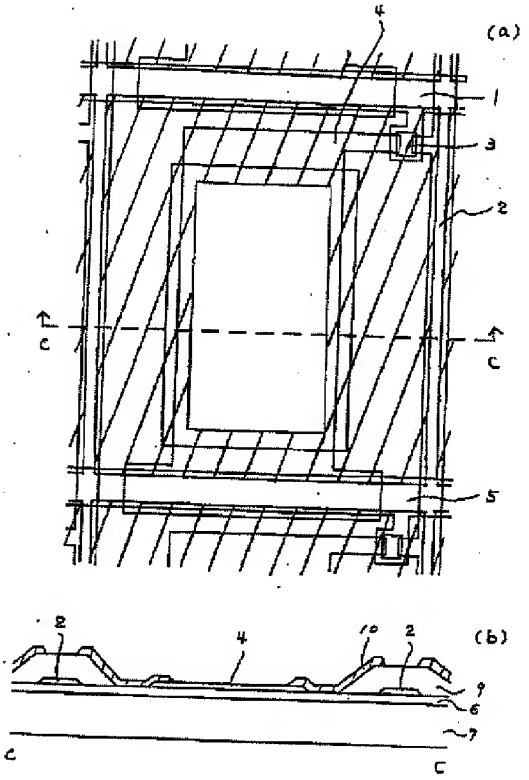
【図3】


17
7
13
14
16
15
10
11
9
6
4
2
7
17
19
20
19
18

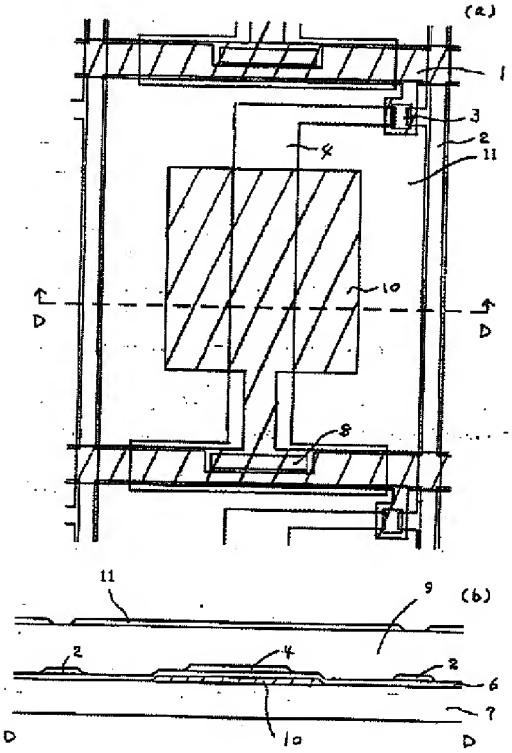
【図4】


(a)
1
3
4
2
B
B
5
(b)
10
11
2
9
6
7
B
B

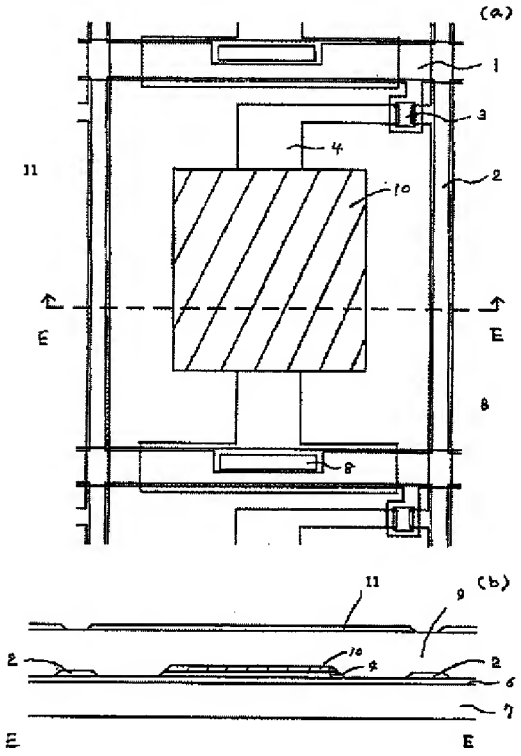
【図5】



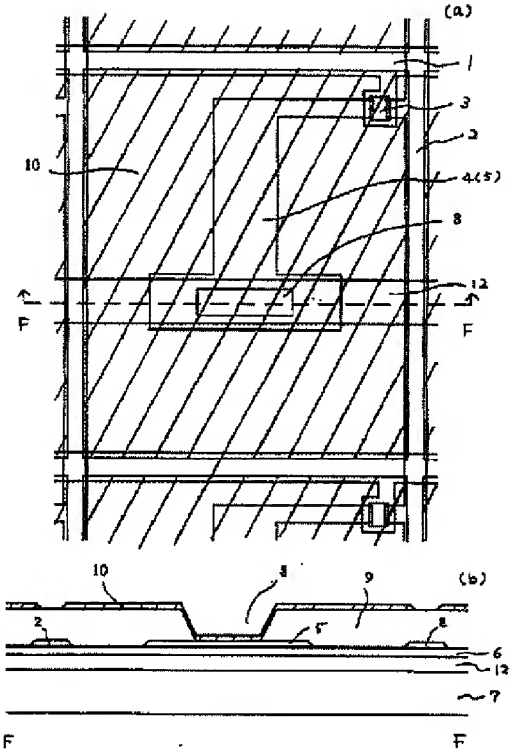
【図6】



【図7】


(a)
1
3
4
11
10
2
E
E
8
8
(b)
11
9
10
2
2
6
7
E
E

【図8】


(a)
1
3
3
10
4(5)
8
12
F
F
(b)
10
8
9
2
5
8
6
12
7
F
F